

**Citation:**

Kwon J, Wilson AN, Bednar C, Kennon L. Food safety knowledge and behaviors of women, infant, and children (WIC) program participants in the United States. J Food Prot. 2008 Aug; 71: 1,651-1,658.

**PubMed ID:** [18724760](#)

**Study Design:**

Cross-sectional study

**Class:**

D - [Click here](#) for explanation of classification scheme.

**Research Design and Implementation Rating:**

NEUTRAL: See Research Design and Implementation Criteria Checklist below.

**Research Purpose:**

- To assess food safety knowledge and food handling behaviors among low-income, high-risk pregnant and lactating women, and parents and guardians of children less than five years of age, participating in the Special Supplemental Nutrition Program for Women, Infants, and Children (WIC)
- To identify sources of food safety information for these populations in order to design appropriate food safety education programs in the future.

**Inclusion Criteria:**

- Pregnant or lactating women or parents or guardians of children enrolled in the Special Supplemental Nutrition Program for WIC
- 18 years or older.

**Exclusion Criteria:**

- Adults not participating in the Special Supplemental Nutrition Program for WIC
- Postpartum, non-lactating women participating in the Special Supplemental Nutrition Program for WIC
- Less than 18 years of age.

**Description of Study Protocol:****Recruitment**

- 200 local WIC offices were randomly selected from approximately 2,200 local WIC offices

nationwide

- Directors of local WIC offices were contacted by mail and telephone to solicit research participation
- WIC directors were asked to administer the survey to 20 adult WIC participants in their programs (i.e., pregnant or lactating women; parents or guardians of children enrolled in the WIC program).

## **Design**

- A questionnaire with questions containing demographics (i.e., age, education level and race or ethnicity), food safety knowledge and food handling behavior was developed
- The questionnaire was edited to a sixth grade reading level, reviewed by eight food safety experts for content validity, translated into Spanish and pilot-tested with 10 English-speaking and 10 Spanish-speaking WIC participants in a north Texas area local WIC office
- Feedback from the expert panel and results of the pilot test were used to revise the questionnaire
- Handwashing questions were not included because authors anticipated a significant halo effect for self-reported handwashing techniques
- Texas Women's University Institutional Review Board reviewed and approved the use of human subjects and the project methodology.

## **Dietary Intake/Dietary Assessment Methodology**

Not applicable.

## **Blinding Used**

Not applicable.

## **Intervention**

Self-administered questionnaire.

## **Statistical Analysis**

- The Statistical Package for Social Sciences software, version 11.5 for Windows was used to perform statistical analyses
- Descriptive statistics summarized the data:
  - Frequencies and percentages described nominal and ordinal data; means and standard deviations (SDs) described interval data
  - Responses to ordinal level questions were stratified by age (18-25 years; older than 25 years), education (some high school or less; high school diploma; beyond high school) and race or ethnicity (non-Hispanic white; non-Hispanic black; Hispanic; other, which included Native American, Asian/Pacific Islander, Other and those who declined to

answer) of the participants and assessed for significance at the  $P < 0.05$  level using chi-square analyses.

- Summary continuous variables for food safety knowledge and food safety behavior scores were created by adding the discrete values of zero or one for individual responses. Knowledge scores ranged from zero to six, and behavior scores ranged from zero to eight. Food handling behavior questions related to cutting board use were scored on a five-point scale using responses of “never,” “seldom,” “sometimes,” “often” and “always.”
- Questionnaire was reviewed by panel of food safety experts for content validity and was pilot-tested by 20 WIC participants (English- and Spanish-speaking)
- Internal reliability was tested using Cronbach’s alpha ( $\alpha \geq 0.85$ ).

## **Data Collection Summary:**

### **Timing of Measurements**

One-time administration of survey questionnaire during WIC office visit.

### **Dependent Variables**

- Food safety knowledge related to cutting board handling, sanitizing, reheating of hot food leftovers and checking doneness of ground beef patties
- Food handling behavior related to cutting board handling, thawing, storing and reheating of hot food leftovers, checking doneness of ground beef patties and handling moldy food items
- Food safety information sources.

### **Independent Variables**

Demographic factors:

- Age (18-25 years, older than 25 years)
- Ethnicity (non-Hispanic white, non-Hispanic black, Hispanic, Other)
- Education (some high school or less, high school diploma, beyond high school).

### **Control Variables**

None mentioned.

## **Description of Actual Data Sample:**

- *Initial N*: 200 WIC directors contacted by telephone; maximum sample size was 4,000 adults 18 years or older throughout the United States
- *Attrition (final N)*:
  - 133 WIC directors contacted by telephone gave verbal consent to participate in the study
  - 87 WIC agencies in 31 states nationwide who returned 15 to 20 completed

- questionnaires
  - 1,598 clients with usable responses
- *Age:*
  - 18.6%; 18 to 21 years
  - 28.8%; 21 to 25 years
  - 22.8%; 26 to 30 years
  - 15.6%; 31 to 35 years
- *Ethnicity:*
  - 47.9%; non-Hispanic white
  - 12.1%; non-Hispanic black
  - 33.2%; Hispanic
- *Other relevant demographics:* The sample was comprised only of women.
  - Education of participants:
    - 20.9%; some high school
    - 36.8%; completed high school
    - 23.7%; some college
    - 9.5%; completed a college degree
    - 9.1%; eight grade level or less education
- *Anthropometrics:* Not applicable
- *Location:* 31 states (specific states or other geographic summary information was not provided).

## Summary of Results:

### Key Findings

- 23.7% recognized the need for thermometers for checking doneness of meat, but only 7.7% reported that they used a thermometer to test doneness of ground beef patties
- Only 50.4% of respondents agreed that they often or always used a cutting board when preparing foods while 91.5% stated that they always cleaned the cutting board or knife after using it for raw meat, poultry or fish, but only 76.1% always sanitized the board or knife after preparing those foods
- While 60% of respondents reported using the most desirable or an acceptable method of thawing frozen meat, poultry or fish, 21.0% thawed frozen food on the counter or in a sink filled with water (20.6%)
- Only 31.5% reported that they cooled quickly, covered and refrigerated hot food leftovers, while 58.1% reported that they reheated those leftovers until steaming hot and 24.4% stated they reheated the food until it was "just warm enough to eat"
- Almost all respondents (94.3%) stated that they threw away an entire package of cream cheese or cottage cheese when mold was found
- Most respondents (77.4%) used color of the meat or juice to check the doneness of meat rather than using a food thermometer
- Regarding food handling behavior questions, the average behavior score was  $5.92 \pm 1.07$  (maximum score 8.0), indicating that respondents reported following acceptable food handling procedures for three-fourths of the items
- More white respondents reported using a food thermometer (46.1%) than did black (36.2%) or Hispanic (25.4%) respondents
- More white respondents reported thawing meat in the refrigerator (44.8%) than did black (29.3%) and Hispanic (23.4%) respondents

- Those older than 25 years had significantly higher knowledge scores ( $4.17 \pm 1.07$ ) and behavior scores ( $6.00 \pm 1.07$ ) than did 18-25 year old respondents ( $4.03 \pm 1.05$  and  $5.84 \pm 1.07$ , respectively ( $P < 0.01$ ))
- Knowledge and behavior scores differed significantly among participants of different education levels and racial or ethnic groups ( $P < 0.001$ ) with those with some high school or less education having significantly lower knowledge and behavior scores than respondents with high school or beyond high school education. Regarding race, white respondents had significantly higher knowledge scores than did Hispanic respondents, the food safety behavior score was not significantly different when comparing white women with their Hispanic counterparts, and black respondents had significantly lower behavior scores than did members of the other three racial or ethnic groups ( $P < 0.001$ )
- Hispanic or black respondents and those who did not graduate from high school were less likely to have used a food thermometer; white respondents with a high school education thawed frozen meat, poultry and fish items more safely than Hispanic and black respondents and those without a high school diploma; and more black respondents consumed undercooked ground beef patties than did whites or Hispanics.

### Other Findings

- The authors found that the top three food safety information sources for WIC participants and parents or guardians of children participating in WIC were, in order of most frequently cited (percentage of respondents who cited the source): WIC (78.7%), Family (63.1%), Television (60.7%)
- Regarding food safety knowledge questions, the overall knowledge score indicated that respondents were knowledgeable about food safety for two-thirds of items asked (mean  $\pm$  SD,  $4.09 \pm 1.07$  with a maximum possible score of 6.0).

### Author Conclusion:

- Results reinforced previous research indicating a gap between what people know about safe food handling and what they actually do (i.e., discrepancies between knowledge and reported food handling behaviors existed in cleaning and sanitizing cutting boards, handling hot food leftovers, using food thermometers and checking doneness of ground beef patties).
- Results of the study suggested the need for food safety education for low-income consumers and different messages to be delivered to specific demographic groups
- Cross-tabulation of age, race and ethnicity and education level with food safety knowledge and handling practices revealed some associations between knowledge and behaviors and demographic characteristics, such as:
  - Respondents older than 25 years old had higher mean food safety knowledge and behavior scores than for those 18-25 years old
  - Hispanic or black respondents and those who did not graduate from high school were less likely to have used a food thermometer
  - White respondents with a high school education thawed frozen meat, poultry and fish items more safely than Hispanic and black respondents than those without a high school diploma
  - More black respondents consumed undercooked ground beef patties than did whites or Hispanics
- The content of future food safety education for low-income consumers should be consistent

with the Fight BAC! themes: Clean, separate, cook and chill as this study revealed a lack of knowledge and the prevalence of undesirable behaviors of low-income consumers in some of those four theme areas. Authors did not find any association between results and geographical location.

### Reviewer Comments:

*A neutral rating was given to this study because:*

- *Sample sizes used to assess food safety knowledge and behaviors were inconsistent across study questions. More specifically, although the authors indicated that N=1,598 for tables presented in the article, footnotes to Tables 2, 3, 4 and 5 indicated, "The total number of responses for each item differs because of missing data."*
- *Non-respondents were included in the proportions calculated in the "other" category for Tables 5 and 7*
- *In Table 1, the "other" category represented respondents who did not indicate any specific resources, yet a response category of "none" was also included in the table without any explanation as to how these two categories differed*
- *Because respondents were only females enrolled in WIC, and the majority were relatively young, study may not be generalized to low-income males, older populations and those not eligible for the WIC Program*
- *Although the local WIC offices were randomly selected, it does not appear that the actual respondents were randomly selected*
- *Results based on self-reported data.*

### Research Design and Implementation Criteria Checklist: Primary Research

#### Relevance Questions

1.	Would implementing the studied intervention or procedure (if found successful) result in improved outcomes for the patients/clients/population group? (Not Applicable for some epidemiological studies)	Yes
2.	Did the authors study an outcome (dependent variable) or topic that the patients/clients/population group would care about?	Yes
3.	Is the focus of the intervention or procedure (independent variable) or topic of study a common issue of concern to nutrition or dietetics practice?	Yes
4.	Is the intervention or procedure feasible? (NA for some epidemiological studies)	N/A

#### Validity Questions

1.	Was the research question clearly stated?	Yes
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1.1.	Was (were) the specific intervention(s) or procedure(s) [independent variable(s)] identified?	Yes
1.2.	Was (were) the outcome(s) [dependent variable(s)] clearly indicated?	Yes
1.3.	Were the target population and setting specified?	Yes
<b>2.</b>	<b>Was the selection of study subjects/patients free from bias?</b>	No
2.1.	Were inclusion/exclusion criteria specified (e.g., risk, point in disease progression, diagnostic or prognosis criteria), and with sufficient detail and without omitting criteria critical to the study?	Yes
2.2.	Were criteria applied equally to all study groups?	Yes
2.3.	Were health, demographics, and other characteristics of subjects described?	No
2.4.	Were the subjects/patients a representative sample of the relevant population?	No
<b>3.</b>	<b>Were study groups comparable?</b>	N/A
3.1.	Was the method of assigning subjects/patients to groups described and unbiased? (Method of randomization identified if RCT)	N/A
3.2.	Were distribution of disease status, prognostic factors, and other factors (e.g., demographics) similar across study groups at baseline?	N/A
3.3.	Were concurrent controls used? (Concurrent preferred over historical controls.)	N/A
3.4.	If cohort study or cross-sectional study, were groups comparable on important confounding factors and/or were preexisting differences accounted for by using appropriate adjustments in statistical analysis?	N/A
3.5.	If case control or cross-sectional study, were potential confounding factors comparable for cases and controls? (If case series or trial with subjects serving as own control, this criterion is not applicable. Criterion may not be applicable in some cross-sectional studies.)	N/A
3.6.	If diagnostic test, was there an independent blind comparison with an appropriate reference standard (e.g., "gold standard")?	N/A
<b>4.</b>	<b>Was method of handling withdrawals described?</b>	No
4.1.	Were follow-up methods described and the same for all groups?	No
4.2.	Was the number, characteristics of withdrawals (i.e., dropouts, lost to follow up, attrition rate) and/or response rate (cross-sectional studies) described for each group? (Follow up goal for a strong study is 80%.)	No



4.3.	Were all enrolled subjects/patients (in the original sample) accounted for?	???
4.4.	Were reasons for withdrawals similar across groups?	???
4.5.	If diagnostic test, was decision to perform reference test not dependent on results of test under study?	N/A
<b>5.</b>	<b>Was blinding used to prevent introduction of bias?</b>	N/A
5.1.	In intervention study, were subjects, clinicians/practitioners, and investigators blinded to treatment group, as appropriate?	N/A
5.2.	Were data collectors blinded for outcomes assessment? (If outcome is measured using an objective test, such as a lab value, this criterion is assumed to be met.)	N/A
5.3.	In cohort study or cross-sectional study, were measurements of outcomes and risk factors blinded?	N/A
5.4.	In case control study, was case definition explicit and case ascertainment not influenced by exposure status?	N/A
5.5.	In diagnostic study, were test results blinded to patient history and other test results?	N/A
<b>6.</b>	<b>Were intervention/therapeutic regimens/exposure factor or procedure and any comparison(s) described in detail? Were intervening factors described?</b>	No
6.1.	In RCT or other intervention trial, were protocols described for all regimens studied?	N/A
6.2.	In observational study, were interventions, study settings, and clinicians/provider described?	No
6.3.	Was the intensity and duration of the intervention or exposure factor sufficient to produce a meaningful effect?	N/A
6.4.	Was the amount of exposure and, if relevant, subject/patient compliance measured?	N/A
6.5.	Were co-interventions (e.g., ancillary treatments, other therapies) described?	N/A
6.6.	Were extra or unplanned treatments described?	N/A
6.7.	Was the information for 6.4, 6.5, and 6.6 assessed the same way for all groups?	N/A
6.8.	In diagnostic study, were details of test administration and replication sufficient?	N/A
<b>7.</b>	<b>Were outcomes clearly defined and the measurements valid and reliable?</b>	Yes
7.1.	Were primary and secondary endpoints described and relevant to the question?	N/A
7.2.	Were nutrition measures appropriate to question and outcomes of concern?	Yes



7.3.	Was the period of follow-up long enough for important outcome(s) to occur?	N/A
7.4.	Were the observations and measurements based on standard, valid, and reliable data collection instruments/tests/procedures?	Yes
7.5.	Was the measurement of effect at an appropriate level of precision?	N/A
7.6.	Were other factors accounted for (measured) that could affect outcomes?	Yes
7.7.	Were the measurements conducted consistently across groups?	Yes
<b>8.</b>	<b>Was the statistical analysis appropriate for the study design and type of outcome indicators?</b>	<b>No</b>
8.1.	Were statistical analyses adequately described and the results reported appropriately?	No
8.2.	Were correct statistical tests used and assumptions of test not violated?	No
8.3.	Were statistics reported with levels of significance and/or confidence intervals?	Yes
8.4.	Was "intent to treat" analysis of outcomes done (and as appropriate, was there an analysis of outcomes for those maximally exposed or a dose-response analysis)?	N/A
8.5.	Were adequate adjustments made for effects of confounding factors that might have affected the outcomes (e.g., multivariate analyses)?	N/A
8.6.	Was clinical significance as well as statistical significance reported?	Yes
8.7.	If negative findings, was a power calculation reported to address type 2 error?	N/A
<b>9.</b>	<b>Are conclusions supported by results with biases and limitations taken into consideration?</b>	<b>No</b>
9.1.	Is there a discussion of findings?	Yes
9.2.	Are biases and study limitations identified and discussed?	No
<b>10.</b>	<b>Is bias due to study's funding or sponsorship unlikely?</b>	<b>Yes</b>
10.1.	Were sources of funding and investigators' affiliations described?	Yes
10.2.	Was the study free from apparent conflict of interest?	Yes